

Serial No. 10/044,276Docket No.: 55476US004**Amendments to the Specification**

Amend the title as shown below in marked form:

SHEET COATER METHOD FOR COATING A LIMITED LENGTH
SUBSTRATE USING ROTATING SUPPORT AND AT LEAST ONE PICK-AND-
PLACE ROLL

Amend paragraphs 0001, 0030, 0035, 0036, 0038 and 0054 as shown below in marked form:

[0001] This application is a continuation-in-part of pending U.S. Patent Application Serial No. 09/757,955 filed January 10, 2001 and entitled COATING DEVICE AND METHOD (now U.S. Patent No. 6,737,113 B1) and of pending U.S. Patent Application Serial No. 09/841,380 filed April 24, 2001 and entitled ELECTROSTATIC SPRAY COATING APPARATUS AND METHOD, the entire disclosures of which are incorporated by reference herein.

[0030] The basic principles of operation of the devices shown in Fig. 1a through Fig. 3 are described in detail in the above-mentioned U.S. Patent Application Serial No. 09/757,955 filed January 10, 2001, and in pending U.S. Patent Application Serial No. ~~(Attorneys Docket No. 55476US003)~~ 10/044,237 filed even date herewith and entitled COATING DEVICE AND METHOD USING PICK-AND-PLACE DEVICES HAVING EQUAL OR SUBSTANTIALLY EQUAL PERIODS, the entire disclosure of which is incorporated by reference herein.

[0035] The improvement diagram in Fig. 4 further illustrates features of our invention. Fig. 4 shows results that can be obtained by applying coating liquid to mounting roll 20 or contacting roll 12 of device 60 in Fig. 1b in a variety of operational modes. The modes involve variation in the contacting roll size and the width of an applied stripe of coating liquid. In Fig. 4 and the other improvement diagrams depicted herein, a uniformity metric

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referred to as the "dimensionless minimum caliper" is calculated by dividing the final minimum coating caliper found on the surface of sheet 24 by the final average coating caliper. The improvement diagram in Fig. 4 is a ~~gray-scale~~ shaded contour plot. The ~~gray levels~~ shadings assigned to various dimensionless minimum caliper ranges are noted in the legend. Black regions represent dimensionless minimum caliper values in the range of 0.3 to 0.6. ~~Dark-gray~~ Black and white-striped regions represent dimensionless minimum caliper values in the range of 0 to 0.3. ~~Light-gray~~ Gray regions represent dimensionless minimum caliper values in the range of 0.6 to 0.9. White regions represent dimensionless minimum caliper values in the range of 0.9 to 1. A dimensionless minimum caliper value of 0.0 indicates there is at least one uncoated spot on sheet 24 after operation of device 60. A dimensionless minimum caliper value of 1.0 indicates a perfectly uniform coating on sheet 24 after operation of device 60.

[0036] It is possible to apply very thick stripes of coating. These will often spread into wider stripes after the first passage through a nip. We define stripe width as the width immediately after the first passage of the stripe through a nip. We also define two dimensionless parameters (referred to in Fig. 4 as the "dimensionless roll size" and "dimensionless stripe width") by dividing the actual contacting roll 12 circumference and the actual stripe width by the actual roll 20 circumference. Every point on the improvement diagram of Fig. 4 thus represents a dimensionless roll 12 circumference and a dimensionless stripe width for the application of a single stripe of coating liquid and operation of device 60 for 20 revolutions. Fig. 4 shows the results for combinations of dimensionless roll 12 sizes from 0 to 1 and dimensionless stripe widths from 0 to 1. Any point location on the improvement diagram represents a pair of choices for these variables. The ~~gray-level~~ shading at that point location represents the attained dimensionless minimum caliper. White regions in Fig. 4 thus represent operating conditions where the combination of roll 12 size and applied stripe width results in "good uniformity" (viz., a dimensionless minimum coating caliper greater than 0.9) across the coated face of sheet 24. ~~Dark-gray~~ Black or black and white-striped regions in Fig. 4 represent operating conditions where the combination of roll 12 size and applied stripe width results in one or more voids or near voids on the coated face of sheet 24.

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[0038] Roll 12 sizes that are integer multiples and proper fractions of the roll 20 size preferably are avoided unless an appropriate value of stripe width is chosen and an adequate number of roll 20 revolutions is used. Fig. 5 is an improvement diagram showing the results obtained for a two roll device (roll 20 plus roll 12) after 200 revolutions of roll 20. The improvement diagram in Fig. 5 has much larger white regions than the improvement diagram in Fig. 4, illustrating the beneficial effect of operating the devices of the invention for a greater number of revolutions. Operating conditions in Fig. 5 in which roll 20 is 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 times larger than roll 12 are not desirable. These correspond to dimensionless roll 12 sizes of 1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7, 1/8, 1/9, and 1/10 and are shown as black, dark-gray black and white-striped or light gray vertically-extending regions in Fig. 5. Other dimensionless roll 12 sizes are also undesirable, such as those shown by the other light gray and black areas in Fig. 5. For example, dimensionless roll sizes corresponding to fractional ratios of 2/5, 2/7 and 2/9 are also undesirable along with roll sizes corresponding to the fractional ratios 3/5, 3/7, 3/8, 3/10 and 3/11.

[0054] The coating liquid can be applied in a variety of uneven patterns other than stripes, and by using methods other than the oscillating needle applicator shown in Fig. 1. For example, a pattern of droplets can be sprayed onto roll 12 or sheet 24 using a suitable non-contacting spray head or other drop-producing device. Examples of suitable drop-producing devices include point source nozzles such as airless, electrostatic, spinning disk and pneumatic spray nozzles. Line source atomization devices are also known and useful. The droplet size may range from very large (e.g., greater than 1 millimeter) to very small. The nozzle or nozzles can be oscillated back and forth across the substrate, e.g. in a manner similar to the above-described needle applicator. Particularly preferred drop-producing devices are described in the above-mentioned U.S. Patent Application Serial No. 09/841,380, and in pending U.S. Patent Application Serial No. 09/841,381 filed April 24, 2001 and entitled VARIABLE ELECTROSTATIC SPRAY COATING APPARATUS AND METHOD (now U.S. Patent No. 6,579,574 B1), the entire disclosure of which is incorporated by reference herein.